# Site Index estimates by Site Series (SIBEC) - second approximation

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## Introduction

British Columbia's Biogeoclimatic Ecosystem Classification (BEC) system organizes our knowledge of ecosystems and provides a framework within which to manage forest resources. This classification system has served as a foundation for forest management decisions for more than 20 years. Since the 1990s, foresters and scientists recognized that correlating BEC site factor information with measures of site productivity, or site index (SI), would greatly enhance our ability to manage certain forest stands.

This Web guide provides background information for the second approximation of site index estimates for tree species according to site units of the Biogeoclimatic Ecosystem Classification system of British Columbia. The estimates themselves are presented in tabular form in two downloadable reports.

The background information consists of seven sections and two appendices. Following this introduction, Section 2 explains the basics of site index. In Section 3, the general relationships between site index and site factors are discussed. Section 4 provides a summary of the methods used to generate the site index estimates presented in the two reports. Section 5 outlines the content and format of the report tables. Section 6 explains how to use the tabular information presented in each report to estimate site index in the field. References to literature cited in this guide are provided in Section 7. Appendix 1 contains a site index species conversion table for mixed species stands. Appendix 2 provides a listing of additional references, resources, and important contacts.

Two reports are available in PDF format and as downloadable Microsoft Excel files. The first report, "Site Index-Site Unit Report by Region" (PDF/Excel), provides a compilation of site index estimates by biogeoclimatic unit for each forest region. The second report, "Site Index-Site Unit Report by Biogeoclimatic Unit" (PDF/Excel), displays site index estimates by site series for each biogeoclimatic subzone/variant.

**The site index estimates provided in these reports are second approximations as they report mean plot site index and its standard error for each BEC site series/species combination that have a minimum sample size of 7. This new estimate replaces the first approximation (1997) site index class estimate only if the minimum sample size criterion is met. As more data become available, subsequent approximations will be produced and named by year, e.g., 2005 approximation.**

**A companion report, "SIBEC comparison report", provides an at-a-glance view of the changes in the latest release of the SIBEC estimates to the 1997 Approximation.**

Site index estimates for some hardwood species are also included in this edition. To contribute data to the provincial SIBEC (Site Index-Biogeoclimatic Ecosystem Classification) data warehouse, please contact the SIBEC Administrator , B.C. Ministry of Forests.

For SIBEC data collection standards, see the Site Productivity Working Group's SIBEC Sampling and Data Standards (Version 5.1).

For timber supply analysis, SIBEC estimates are usually applied using ecosystem mapping, either predictive (PEM) or terrestrial (TEM), but may also be applied by sampling the landbase to determine the proportion of each BEC site series. The Technical Report "SIBEC Site Index Estimates in Support of Forest Management in British Columbia" by Mah and Nigh (2003)

evaluates the accuracy of the SIBEC estimates for use in supporting allowable annual cut (AAC) determinations.

## 2. Site Index Explained

Site index is the most common measure of forest site productivity and forest growth used in British Columbia. These estimates of site productivity serve as an important baseline for forest-level planning and help to formulate silviculture strategies.

### 2.1 What is Site Index?

For a particular target species, site index is the height of the largest diameter (at breast height) site tree on a 0.01 ha plot at breast height age 50, provided the tree is suitable. A suitable site tree is a vigorous dominant or co-dominant tree that has a full crown and a straight, disease-free, undamaged stem. It is free of suppression above breast height, is not repressed, and is not a wolf, open-grown, or veteran tree.

### 2.2 Why is Site Index Important in Forest Management?

Site index provides a numeric description of site productivity that enables forest managers to predict forest stand growth and the yield of timber at harvest.

Estimates of site index are important in the following areas of forest management.

- Silviculture: to describe site quality, formulate prescriptions, schedule and rank treatments, and predict stand growth and yield.
- Timber supply analyses: to estimate years to green-up, the size of the operable land base, the minimum harvestable age, the yield of regenerated stands, and the growth of existing stands.
- Inventory: to describe site quality and project inventory volume growth.

Site index allows the comparison of productive potential between sites across a broad range of existing stand conditions. For example, a stand of Douglas-fir that is taller at breast height age 50 than another similar-aged stand of the same species will have a higher site index. It should achieve a greater timber volume, and therefore be more productive, than the stand with the lower site index.

As measures of site productivity, these estimates influence timber supply analyses and support the Chief Forester's decisions on allowable annual cut. By allowing forest managers to predict the outcome of a particular forest practice, site index estimates are also important inputs to land-use decisions and analyses of silviculture investments.

### 2.3 What Tools are Available to Measure Site Index?

For many stands, more than one acceptable way exists to estimate site index. The methods either involve "direct" measurement of site trees and the subsequent calculation of site index, or the "indirect" estimation of site index from various site factors. These two types of methods differ both in their suitability for different stand conditions and their accuracy.

The most common site index estimation tools available in British Columbia involve the use of models-mathematical equations that allow one attribute to be estimated from other attributes (e.g., in growth intercept models, site index is estimated from height and breast height age). The

three models briefly described here are each suited to specific stages of stand development (see Figure 1).

*Height-age Models:* Also known as site index models, or curves, the primary purpose of these models is to describe height development over time for different levels of site index. These models also allow estimates of site index from height and breast height age data. Each tree species requires a different model because height growth characteristics are not the same for all species. This method is best used for stands that have between 50- and 140-years growth above breast height.

*Growth Intercept Models:* These species-specific models are designed explicitly for young stands (5-50 years breast height age). The growth intercept technique estimates site index from the average annual height growth of site trees, which is determined either from the distance between annual branch whorls or from the height and breast height age of the tree.

*Site Index-Biogeoclimatic Ecosystem Classification (SIBEC) Models:* This comprehensive tool correlates site index with site series within biogeoclimatic ecosystem classification (BEC) units and site series. The BEC system is designed specifically for British Columbia's ecosystems. This model is best used for very young stands, very old stands, and stands not suitable for other methods.

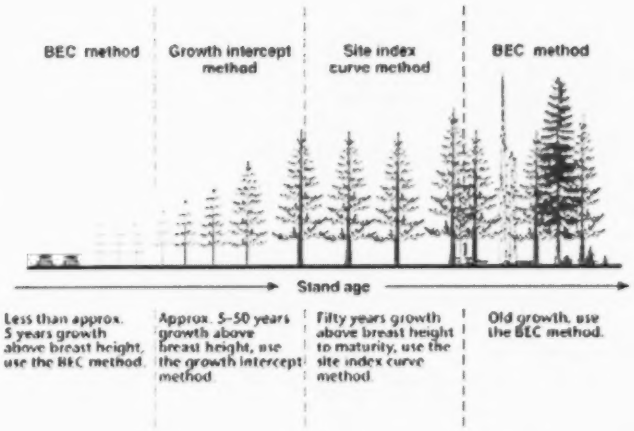

BEC method
Growth intercept method
Site index curve method
BEC method
Stand age
Less than approx. 5 years growth above breast height, use the BEC method.
Approx. 5–50 years growth above breast height, use the growth intercept method.
Fifty years growth above breast height to maturity, use the site index curve method.
Old growth, use the BEC method.

**FIGURE 1.** Site index methods used at various stand ages. The use of any of these methods depends on the type and quality of the available data.

Other site index tools currently in use, or being developed for use, within British Columbia include:

- *Species Conversion Models:* Estimate the site index of one species from that of another species in a mixed stand.
- *Old Growth Site Index (OGSI) Adjustments:* Estimate site index for a regenerated stand from an adjusted site index of an old-growth stand.

## 3. Relationships Between Site Index And Site Factors

The biogeoclimatic ecosystem classification (BEC) system organizes our knowledge of ecosystems and serves as a framework within which to manage resources. It helps to divide landscapes into ecologically uniform segments at various levels of integration (regional, local, and chronological) and generalization (climatic, or "zonal," vegetation, and site). At the local level of integration, landscapes are stratified using vegetation and soils information into vegetation and site units (i.e., site series and site associations).

A narrow range of environmental conditions, or an "environmental gradient" distinguishes each site series. This gradient will usually provide distinct growth potentials for a given tree species over a fixed time period.

Tree growth is influenced by various site factors, which taken together, determine the site's quality. These growth, or site, factors include climate (light and temperature) and soil moisture, nutrients, and aeration. In general, the potential tree growth, or site index, is greatest on moist sites and increases with soil fertility.

It is possible to use a simple equation to highlight the functional relationships between site index and site factors:

- site index = f (temperature, soil moisture, and soil nutrients)

On sites where these site factors are in balance, trees grow well and site index is higher; on sites where these factors are in excess or are deficient, trees grow less well and site index is lower. However, the site index of a species varies between biogeoclimatic units and the precise relationship is not always clear based on any single variable. The influence of climate or soil moisture or soil nutrients on site index is most likely a result of the interaction of site factors.

In this section, some relationships between site index and site factors are examined. The presence of these relationships has been documented for several species and sites (e.g., Green et al. 1989; Carter and Klinka 1990; Klinka and Carter 1990; Wang et al. 1994a, 1994b; Wang and Klinka 1995; Wang and Klinka 1996; Kayahara and Pearson 1996; Splechtna 2001).

### 3.1 Biogeoclimatic Units and Site Index

Biogeoclimatic unit-biogeoclimatic subzones and their variants-represent groupings of contiguous ecosystems influenced by a discrete regional climate. Because climate is the most important determinant of plant growth, the site index for a given species will most likely vary from climate to climate or from subzone to subzone.

The effect of climate on site index is best detected by comparing site index on zonal sites between different subzones. For example, Douglas-fir site index shows a reasonably positive relationship with increasing precipitation in the selected sequence of Coastal Douglas-fir (CDF) and Coastal Western Hemlock (CWH) biogeoclimatic units; however, the relationship to the selected temperature variables is not as strong (see Table 1).

**Table 1**. Summary of selected climate data (average of stations) and estimated Douglas-fir (Fd) site index on zonal sites for some southern coastal biogeoclimatic subzones

| | Subzone (1) | | | |
|---|---|---|---|---|
| **Variable** | **CDFmm** | **CWHxm** | **CWHdm** | **CWHvm** |
| Mean annual precipitation (mm) | 966 | 1603 | 1823 | 2787 |
| Mean summer precipitation (mm) | 170 | 293 | 384 | 577 |
| Mean annual temperature (°C) | 9.7 | 9.2 | 9.8 | 8.2 |
| Accumulated degree days <0°C | 33 | 58 | 50 | 109 |
| Accumulated degree days > 5°C | 1929 | 1875 | 2050 | 1627 |
| Fd site index (m @50 yr bh) | 23.5 | 30.3 | 32.6 | 34.8 |

1. *Subzone abbreviations:*
*CDFmm = Coastal Douglas-fir moist mild;*
*CWHxm = Coastal Western Hemlock very dry mild;*
*CWHdm = Coastal Western Hemlock dry mild;*
*CWHvm = Coastal Western Hemlock very wet mild.*

## 3.2 Soil Moisture and Site Index

In general, site index increases from water-deficient to moist sites and decreases from moist to wet sites. This trend is demonstrated for lodgepole pine and interior spruce using results from Kayahara et al. (1996) in Figure 2.

In this example, statistical analysis indicated the presence of a strong productivity gradient that coincided with the assumed soil moisture gradient. The mean site index of the study species increased from very dry to fresh sites, reached a plateau on moist sites, and then decreased from moist to wet sites (Figure 2). The highest mean site index of any study species always occurred on sites with no water deficit or surplus during the growing season. The lowest site index always occurred on very dry or wet sites.

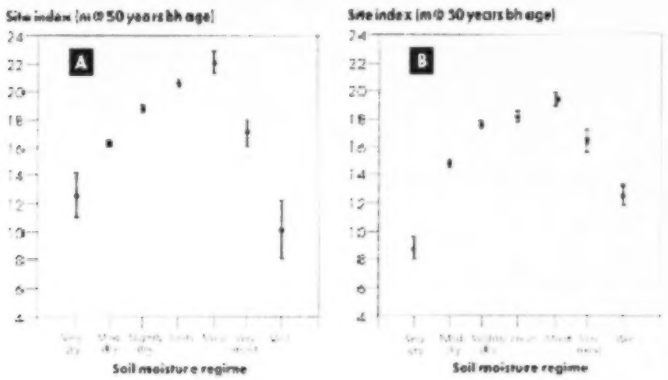



**Figure 2.** Categorical plots of lodgepole pine (A) and interior spruce (B) mean site index for Sub-Boreal Spruce zone stands on nutrient poor and medium sites according to actual soil moisture regimes. Vertical bars represent ±1 standard error.

## 3.3 Soil Nutrients and Site Index

Site index usually increases with an increasing supply of available soil nutrients, particularly nitrogen. This trend is demonstrated for lodgepole pine and interior spruce using results from Kayahara et al. (1996) in Figure 3.

In this example, a strong productivity gradient was evident that coincided with the assumed soil nutrient gradient. The mean site index of all study species increased consistently from very poor to very rich sites (Figure 3). The highest site index for all species always occurred on sites very rich in nitrogen.

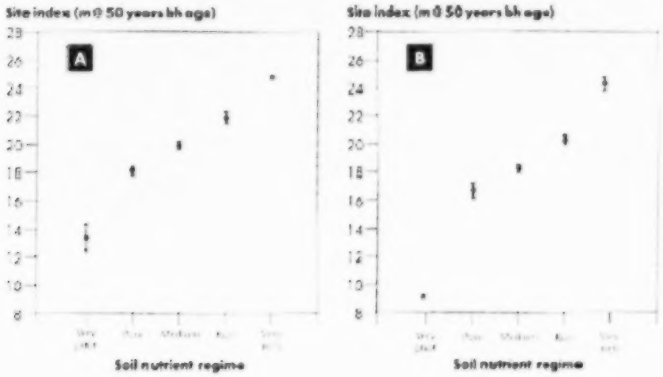



**Figure 3.** Categorical plots of lodgepole pine (A) and interior spruce (B) mean site index for Sub-Boreal Spruce zone stands on slightly dry and fresh sites according to soil nutrient regimes. Vertical bars represent ±1 standard error.

## 3.4 Integrating Site Factors and Site Index

The combined effect of soil moisture and nutrients on site index for a given climate or group of similar climates (subzones, or a group of climatically similar subzones) is most effectively displayed on the edatopic grid (Figure 4). Each cell (edatope) on the grid represents a group of sites with a very narrow range in soil moisture and nutrient conditions. Under any soil nutrient conditions, the site index of most species generally increases from very dry to moist sites and then decreases from moist to wet sites. Under any soil moisture conditions, site index generally increases from very poor through very rich sites.

This general trend is demonstrated for western hemlock in Figure 4. The site index estimates presented are for the most common, diagonal sequence of edatopes-slightly dry to moist and poor to rich.

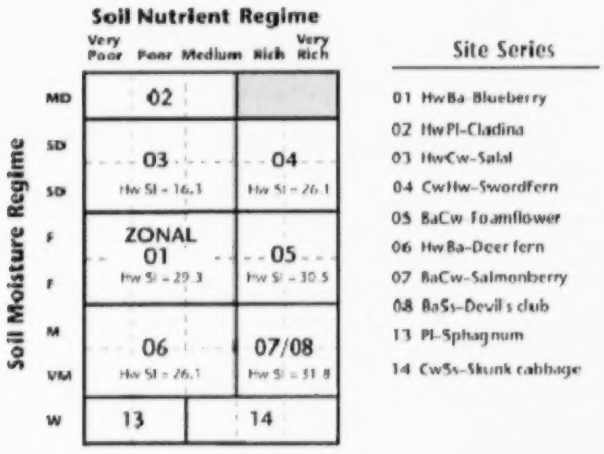



**Figure 4.** Edatopic grid for the Submontane Very Wet Maritime variant of the Coastal Western Hemlock zone. Mean site index is given for western hemlock (Hw).

## 3.5 Tree Species and Site Index

Broad similarities exist in the relationships between average site index and biogeoclimatic unit and edatopic grid position among tree species. However, within this broad, general pattern of similarities, important differences are also evident between species. These differences arise because species respond differently to a given combination or level of growth factors.

A typical example is provided in Figure 2. Average site index for both lodgepole pine and interior spruce increases with increasing soil moisture. However, the site index for pine is greater than for spruce on very dry to moist sites. On very moist and wet sites, the difference is less pronounced. Figure 3 shows the average site index of both species responding similarly to soil nutrients-again with pine showing a consistently higher site index.

## 4. Procedures Used To Produce Second Approximation SIBEC Estimates

The provincial SIBEC database was initially compiled in 1994-5 (Thrower et al. 1995), and the first approximation estimates of site index by site unit were completed and published in 1997 (B.C. Ministry of Forests 1997). At the time these estimates were released, they were considered the best available for the Biogeoclimatic Ecosystem Classification (BEC) site series and species combinations. At that time, the model developers realized that the accuracy and precision of these estimates would improve over time through a process of continued data acquisition and refinements to the analysis tools. The following points describe these refinements and the procedures used to generate the updated second approximation estimates.

- SIBEC data and sampling standards were developed in 1997. These standards have received subsequent revisions in the past few years. The most recent set of standards (version 5.1) came out in June 2001 (B.C. Ministry of Forests Site Productivity Working Group 2001).
- After 1995, new data were collected for the provincial SIBEC data warehouse, a central repository for ecological and mensuration data. This data came from work carried out on Tree Farm Licenses, Innovative Forest Practices Agreement lands, Permanent Sample

Plots, and other projects. In 2000-01, the SIBEC data warehouse was re-designed and modelled to efficiently store and retrieve all data fields. A modified VENUS data model was used to develop data entry and reporting tools. Approximately 2200 new records have been added to the data warehouse.

- In 2001-02, a SIBEC administrator analysis tool was designed and developed to create a SIBEC Reporting Data Mart (RDM). The RDM obtains specific data from the SIBEC data warehouse to complete mean site index calculations for each BEC site series/tree species combination. This process allows the generation of the site index site series (SISU) reports by region and biogeoclimatic unit.
- The following methodology is used for analysis and reporting of second approximation estimates:
    - New data are added to the provincial SIBEC data warehouse. Site index is calculated for all plots with available data. Mean plot site index and its standard error are calculated for each BEC site series/species combination that have a minimum sample size of 7.
    - This new estimate replaces the first approximation estimate. However, BEC site series/species combinations that do not have the minimum number of samples will retain the first approximation site index class estimate in the reports.

What are the main differences between the first and the second approximation estimates?

- **Improved accuracy:** The second approximation site index estimates are obtained through the addition of new data collected following the revised SIBEC data and sampling standards for ecological and site tree data. In addition, previously collected data were reviewed, and those data inadequately meeting the current data and sampling standards were removed from the database.
- **Added Precision Estimates:** First approximation site index reliability ratings are replaced by the mean site index and standard error of the mean.
- **Expanded coverage:** Site index estimates for some hardwood tree species are also included.

## 5. Content And Format Of The Site Index-Site Unit Reports

The two site index reports provide estimates of average site index by site unit for tree species in British Columbia. These reports group the site index estimates by region and by biogeoclimatic unit.

### 5.1 Content of the Site Index-Site Unit Reports

Where a given tree species is present within the site series, a site index point estimate is given along with its associated standard error and the number of sample plots on which the site index data are based. For some site series, the estimates did not have sufficient samples and these estimates are reported as site index class mid-points (see Table 2). Therefore, the estimates provided in the reports are a mix of:

- second approximation mean site index estimates (or point estimates), and
- first approximation site index class estimates.

See Section 4 for more information about these two types of estimates.

**Table 2**

| Coast (1) | | Interior (2) | |
|---|---|---|---|
| **Site index** | **Site class** | **Site index** | **Site class** |
| 0.0-5.9 | 4 | 0.0-4.4 | 3 |
| 6.0-9.9 | 8 | 4.5-7.4 | 6 |
| 10.0-13.9 | 12 | 7.5-10.4 | 9 |
| 14.0-17.9 | 16 | 10.5-13.4 | 12 |
| 18.0-21.9 | 20 | 13.5-16.4 | 15 |
| 22.0-25.9 | 24 | 16.5-19.4 | 18 |
| 26.0-29.9 | 28 | 19.5-22.4 | 21 |
| 30.0-33.9 | 32 | 22.5-25.4 | 24 |
| 34.0-37.9 | 36 | 25.5-28.4 | 27 |
| 38.0-41.9 | 40 | 28.5-31.4 | 30 |
| 42.0-45.9 | 44 | 31.5-34.4 | 33 |
| 46.0-49.9 | 48 | 34.5-37.4 | 36 |
| 50.0-53.9 | 52 | 37.5-40.4 | 39 |

1. *CWH, CDF, and MH zones*
2. *All other zones*

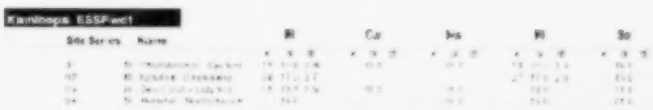
In general, site index class estimates use 3-m classes, with the exception being the Coastal Western Hemlock (CWH), Coastal Douglas-fir (CDF), and Mountain Hemlock (MH) zones, where 4-m classes are used. Classes were used for first approximation estimates to dampen some of the inherent variability in the raw data, make it easier for experts to verify and adjust the regression estimates if required, and to suggest to users an approximate level of precision.

## 5.2 Format of the Two Site Index-Site Unit Reports

In the Site Index-Site Unit Report by Region (PDF/Excel), the tables for biogeoclimatic subzones and variants (BGC units) are indexed alphabetically by forest region and BGC units. There is one table for each forested BGC unit in the region.

Each regional BGC unit table contains a data column for each coniferous tree species occurring in the unit and a row for each of the reported site series. Point estimates of mean plot site index are accompanied by the associated sample size and the standard error. Site index class estimates are also included in this report (see Figure 5). Most non-forested site series (wetlands and grasslands) are excluded.

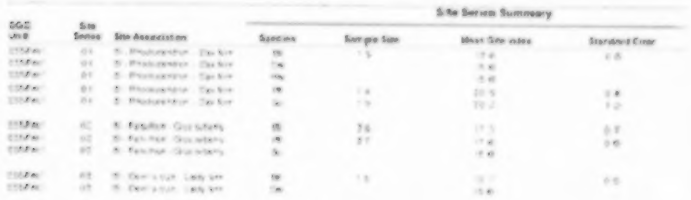
**Figure 5.** The tabular format of the Site Index-Site Unit Report by Region.



In the Site Index-Site Unit Report by Biogeoclimatic Unit (PDF/Excel), the tables are indexed alphabetically by biogeoclimatic subzones and variants (BGC units) and numerically by site series associations.

The Report by Biogeoclimatic Unit contains both point estimates of mean plot site index and site index class estimates. The site series data summary provided includes tree species abbreviations, sample size, mean site index, and associated standard error (see Figure 6).

**Figure 6.** The tabular format of the Site Index-Site Unit Report by Biogeoclimatic Unit.



## 6. Using The SIBEC Model To Estimate Site Index In The Field

When required to estimate the site index for a selected species, several methods are often appropriate. These methods differ in their availability throughout the province, their suitability for different stand conditions, and their accuracy. The BEC method is appropriate where:

- stand conditions are unsuitable for using growth intercept or site index curve methods (see Figure 1), and
- a correct site identification of the area can be obtained.

Where sample tree conditions are suitable, careful use of either the growth intercept or site index curve methods is generally more accurate than the BEC method. Frequently though, stand conditions are unsuitable for these methods as, for example, in the situations listed below. Under each of these circumstances the BEC method is preferred.

- uneven-aged stands
- very old stands (age class 8 and 9)
- stands where sample trees are very large or rotten at breast height
- stands where many sample trees have stem damage (forks, broken tops, dead tops)
- stands with significant forest health problems
- stands that have received heavy partial cutting
- stands where treatment has modified sample tree height growth (e.g., fertilization temporarily accelerating height growth, or thinning shock temporarily slowing height growth)
- stands that regenerated densely, particularly lodgepole pine

A general procedure for applying the BEC method in the field follows. For timber supply review purposes, please contact Forest Analysis Branch for guidance on applying the BEC method.

### 6.1 Determine site series

The first step in using the BEC method to estimate site index for a stand is to determine the biogeoclimatic unit (zone, subzone/variant) and site series. Ideally, only one site series will exist; however, because of the inherent variability of many sites, a stand may contain more than one site series. For instance, if a surveyor using objectives other than ecological uniformity stratified the stand, more than one site series may result. In cases where stands contain more than one site series, estimate the percentage of stand area by site series.

### 6.2 Select the site index species

Select the desired site index species for the stand. The site index species is the tree species for which site index is estimated. Generally, site index is required for the leading species on both the

inventory and silviculture forest cover map labels. In a forest cover map label, site index refers to the leading species on the particular site. Each species on a site has a unique site index.

When selecting site index species, check the tables in either the Site Index-Site Unit Report by Region or the Site Index-Site Unit Report by Biogeoclimatic Unit to see which species have site index estimates available for the site series in your stand. If the tables do not have entries for the leading species in your stand, consider using a species conversion. An updated species conversion table is provided in Appendix 1. If no conversion is available,often the next best option is to apply the site index of a similar species to the other species.

### 6.3 Look up the site index value in the Site Index-Site Unit Report tables

Once zone, subzone/variant, site series, and species are identified for the stratum, proceed to the tables in the Site Index-Site Unit Report by Biogeoclimatic Unit to look up the site index estimate. As mentioned above, estimates may not be available for some site series-species combinations.

### 6.4 Compute average site index

If the stand contains more than one site series, it will be necessary to determine the average site index. To compute the average site index for the stand, average the site indices of each site series in the stand - weighting each value by the amount of the stand area in each site series.

## 7. Literature Cited

**British Columbia Ministry of Forests. 1997.** Site index estimates by site series for coniferous tree species in British Columbia. Forest Renewal BC and B.C. Ministry of Forests. Victoria, B.C.

**Carter, R.E. and K. Klinka. 1990.** Relationships between growing-season soil water deficit, mineralizable soil nitrogen, and site index of coastal Douglas-fir. Forest Ecology and Management 30:301-311.

**Consortium of Thrower, Blackwell, Oikos. 1995.** A SIBEC Project Report: Database design and collation. June 5, 1995.

**Green, R.N., P.L. Marshall, and K. Klinka. 1989.** Estimating site index of Douglas-fir (Pseudotsuga menziesii [Mirb.] Franco) from ecological variables in southwestern British Columbia. Forest Science 35:50-63.

**Kayahara, G.J. and A.F. Pearson. 1996.** Site index of western hemlock (Tsuga heterophylla) and Sitka spruce (Picea sitchensis) in relation to soil moisture regimes and soil nutrient regimes. B.C. Min. For., Victoria, B.C. Working Paper No. 17/1996.

**Kayahara, G., K. Klinka, and P. Marshall. 1996.** The relations of site index to site factors for lodgepole pine, interior spruce, and subalpine fir in central British Columbia, Canada. B.C. Min. For., Victoria, B.C. Unpublished Report.

**Klinka, K. and R.E. Carter. 1990.** Relationships between site index and synoptic environmental factors in immature coastal Douglas-fir stands. Forest Science 36:815-830.

**Site Productivity Working Group. 2001.** SIBEC sampling and data standards (Version 5.1). B.C. Ministry of Forests, Victoria, B.C. [web site].

**Splechtna, B.E. 2001.** Height growth and site index models for Pacific silver fir in southwestern British Columbia. BC Journal of Ecosystems and Management 1(1):1-14. [Download the PDF].

**Wang, G.G. and K. Klinka. 1995.** Site-specific height curves for white spruce (Picea glauca (Moench) Voss) stands based on stem analysis and site classifdication. Annales des Sciences Forestieres. 52:607-618.

**Wang, G.G. and K. Klinka. 1996.** Use of synoptic variables in predicting white spruce site index. Forest Ecology and Management 80:95-105.

**Wang,Q., G.G. Wang, K.D. Coates, and K. Klinka. 1994a.** Use of site factors to predict lodgepole pine and interior spruce site index in the Sub-Boreal Spruce zone. B.C. Min. For. Victoria, B.C. Research Note No. 114.

_____. **1994b.** Relationships between ecological site quality and site index of lodgepole pine and white spruce in Northern British Columbia. Chinese Journal of Applied Ecology. 5(1):1-15.

## APPENDIX 1 - Site Index Species Conversions For Mixed Species Stands

The site index species conversion tables below provide the average site index expected for a species when site index is known for another species growing on the same site. The text that follows provides the background to assist in using the tables properly.

### When Will These Tables Be Useful?

These tables are useful when site index is in a SISU table for one species and it is required for another species but the site index cannot be obtained using other methods, including SIBEC. Rather than assume that both species have the same site index, use the conversion table to improve the estimate of the site index for the second species.

### Why Not Assume All Species On Site Have The Same Site Index?

You should not assume that the site index determined for one species can be applied to all other species on the site. On any forest site, trees of one species will grow faster or slower than trees of a second species. A site may be good for one tree species, but only fair for a second species. Each species on the site has a unique site index.

### How To Use The Tables

To use the conversion tables, determine the site index of one species from the SISU tables. Find the conversion table that corresponds to this species and look up the site index predicted for a second species on the same site. For example, if the SISU-based site index was 22 m for Sx in an Interior stand, find the table labelled "When You Know Interior Sx Site Index." Look across the section heading to find the column for site index 22 m. Look down this column to find that the average site index predicted for Fd on the same site is 21 m.

### Notes

These estimates are based on the average site index relationship between species. On any individual site, the site index for the second species may differ from the average provided in the table. The most accurate site index for a second species on site is obtained by collecting growth intercept or site index curve data on suitable sample trees of the second species. However, on average, using the conversion table will provide you with better site index estimates than if you simply assume that all species on site have the same site index.

Also see Research Branch's SiteTools website for electronic site index species conversion tables.

## Average Site Index Relationships for Interior Species

### When you know interior Bl site index (1)

| The species that can be predicted | Average site index (m) relationship | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| Interior Pl | 10.4 | 12.6 | 14.7 | 16.9 | 19.1 | 21.3 | 23.5 | 25.6 | 27.8 | 30.0 | 32.2 |
| Interior Sw | 9.7 | 12.0 | 14.3 | 16.7 | 19.0 | 21.3 | 23.6 | 26.0 | 28.3 | 30.6 | 32.9 |

1. *Example: If you have data that were gathered on interior Bl that indicates a site index of 22, it can be used to predict that the site index of interior white spruce will be 23.6.*

### When You Know Interior Fd Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Pl | 9.9 | 12.1 | 14.2 | 16.4 | 18.5 | 20.6 | 22.8 | 24.9 | 27.1 | 29.2 | 31.3 |
| Interior Sw | 7.1 | 9.8 | 12.6 | 15.3 | 18.0 | 20.7 | 23.4 | 26.1 | 28.8 | 31.5 | 34.3 |
| Interior Hw | 6.1 | 8.4 | 10.6 | 12.9 | 15.2 | 17.4 | 19.7 | 21.9 | 24.2 | 26.4 | 28.7 |
| Interior Lw | 10.9 | 12.9 | 14.9 | 17.0 | 19.0 | 21.0 | 23.1 | 25.1 | 27.2 | 29.2 | 31.2 |

### When You Know Interior Hw Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Fd | 13.4 | 15.2 | 17.0 | 18.8 | 20.5 | 22.3 | 24.1 | 25.8 | 27.6 | 29.4 | 31.2 |

### When You Know Interior Lw Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Pl | 8.4 | 10.5 | 12.6 | 14.6 | 16.7 | 18.8 | 20.9 | 23.0 | 25.0 | 27.1 | 29.2 |
| Interior Fd | 9.1 | 11.1 | 13.1 | 15.0 | 17.0 | 19.0 | 20.9 | 22.9 | 24.9 | 26.8 | 28.8 |

### When You Know Interior Pl Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Bl | 9.6 | 11.5 | 13.3 | 15.2 | 17.0 | 18.8 | 20.7 | 22.5 | 24.3 | 26.2 | 28.0 |
| Interior Fd | 10.1 | 11.9 | 13.8 | 15.7 | 17.5 | 19.4 | 21.3 | 23.1 | 25.0 | 26.9 | 28.7 |
| Interior Lw | 11.5 | 13.5 | 15.4 | 17.3 | 19.2 | 21.2 | 23.1 | 25.0 | 26.9 | 28.8 | 30.8 |
| Interior Sb | 9.2 | 10.4 | 11.7 | 13.0 | 14.3 | 15.5 | 16.8 | 18.1 | 19.4 | 20.6 | 21.9 |
| Interior Sx | 8.7 | 10.9 | 13.1 | 15.2 | 17.4 | 19.6 | 21.8 | 23.9 | 26.1 | 28.3 | 30.5 |

### When You Know Interior Sb Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Pl | 11.3 | 14.5 | 17.6 | 20.7 | 23.9 | 27.0 | 30.1 | 33.3 | 36.4 | 39.5 | 42.7 |

### When You Know Interior Sx Site Index

| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Interior Bl | 10.3 | 12.0 | 13.7 | 15.4 | 17.2 | 18.9 | 20.6 | 22.3 | 24.0 | 25.8 | 27.5 |
| Interior Fd | 12.1 | 13.6 | 15.1 | 16.5 | 18.0 | 19.5 | 21.0 | 22.4 | 23.9 | 25.4 | 26.9 |
| Interior Pl | 11.2 | 13.0 | 14.9 | 16.7 | 18.5 | 20.4 | 22.2 | 24.1 | 25.9 | 27.7 | 29.6 |

## Average Site Index Relationships for Coastal Species

### When You Know Coastal Ba Site Index

| | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Hw | 17.2 | 20.3 | 23.3 | 26.3 | 29.4 | 32.4 | 35.5 | 38.5 | 41.6 | 44.6 |

### When You Know Coastal Cw Site Index

| | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Hw | 17.0 | 20.1 | 23.3 | 26.4 | 29.6 | 32.7 | 35.8 | 39.0 | 42.1 | 45.3 |

### When You Know Coastal Fd Site Index

| | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Hw | 13.1 | 15.7 | 18.4 | 21.1 | 23.8 | 26.5 | 29.2 | 31.9 | 34.6 | 37.3 |

### When You Know Coastal Hw Site Index

| | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Fd | 17.2 | 20.5 | 23.8 | 27.2 | 30.5 | 33.9 | 37.2 | 40.5 | 43.9 | 47.2 |
| Coastal Ss | 13.8 | 17.5 | 21.3 | 25.0 | 28.8 | 32.5 | 36.3 | 40.0 | 43.7 | 47.5 |
| Coastal Cw | 13.1 | 16.0 | 18.8 | 21.7 | 24.6 | 27.4 | 30.3 | 33.2 | 36.0 | 38.9 |
| Coastal Ba | 12.8 | 15.8 | 18.7 | 21.7 | 24.6 | 27.6 | 30.6 | 33.5 | 36.5 | 39.4 |

### When You Know Coastal Ss Site Index

| | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coastal Hw | 16.0 | 18.4 | 20.8 | 23.2 | 25.6 | 28.0 | 30.4 | 32.8 | 35.2 | 37.6 |

## APPENDIX 2 - References, Resources, And Contacts

### References

**Banner, A., W. MacKenzie, S. Haeussler, S. Thomson, J. Pojar, and R. Trowbridge. 1993.** A field guide for site identification and interpretation in the Prince Rupert Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 26.

**Braumandl, T. and M. Curran. 1992.** A field guide for site identification and interpretation in the Nelson Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 20.

**DeLong, C., D. Tanner, and M.J. Jull. 1993.** A field guide for site identification and interpretation for the southwest portion of the Prince George Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 24.

**DeLong, C., D. Tanner, and M.J. Jull. 1994.** A field guide for site identification and interpretation for the Northern Rockies portion of the Prince George Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 29.

**Green, R.N. and K. Klinka. 1994.** A field guide for site identification and interpretation in the Vancouver Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 28.

**Lloyd, D., K. Angove, G. Hope, and C. Thompson. 1990.** A guide to site identification and interpretation for the Kamloops Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 23.

**Nigh, G. 1998.** Site index: A primer.

**Stearns-Smith, S. 2001.** Making sense of site index estimates in British Columbia: A quick look at the big picture. BC Journal of Ecosystems and Management 1(2):1-4.

**Steen, O.A. and R.A. Coupé. 1998.** A field guide to forest site identification and interpretation for the Cariboo Forest Region. B.C. Min. For., Victoria, B.C. Land Management Handbook No. 39.
Supplement 1, ESSFxv2 site series classification, 2001.
Supplement 2, SBSmw site series expanded classification, 2002.

### Resources

The B.C. Ministry of Forests Biogeoclimatic Zone Ecology Brochure Series:
Ecosystems of British Columbia (1994)
The Ecology of the Coastal Douglas-fir Zone (1995)
The Ecology of the Coastal Western Hemlock Zone (1995)
The Ecology of the Interior Douglas-fir Zone (1996)
The Ecology of the Interior Cedar-Hemlock Zone (1996)
The Ecology of the Boreal White and Black Spruce Zone (1996)
The Ecology of the Mountain Hemlock Zone (1997)
The Ecology of the Sub-Boreal Spruce Zone (1998)
The Ecology of the Bunchgrass Zone (1998)
The Ecology of the Engelmann Spruce-Subalpine Fir Zone (1998)
The Ecology of the Alpine Tundra Zone (1998)
The Ecology of the Sub-Boreal Pine-Spruce Zone (1999)

The Ecology of the Ponderosa Pine Zone (1999)
The Ecology of the Spruce-Willow-Birch Zone (1999)
The Ecology of the Montane Spruce Zone (1999)

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